REMARKS

The Official Action of April 5, 2004, and the prior art cited and relied upon therein have been carefully studied. The claims in the application are now claims 1-3, and these claims define patentable subject matter warranting their allowance. Favorable reconsideration and such allowance are respectfully urged.

Claims 1-3 remain in the application for consideration.

As the Examiner will note, Applicant has amended the specification and claim 1 to change the term "one-third" to "two-thirds". This was necessary due to a mistranslation from Applicant's Japanese priority patent to this application. The original English text of this application says "an annular corner where the inside peripheral surface 24 merges with any one end of the axially opposing end surfaces 25 of the semicircular rims 3 is chamfered off into a depth teaching one-third the axial thickness of the associated rim 3 to form a slant annular surface 21, which slopes... less than 45 deg,". This description should have been translated to two-thirds the axial thickness of the associated rim 3 to form a slant annular surface 21,...". Applicant submits that the chamfered depth is not one-third the axial thickness of the

rim 3, but two-thirds and is obvious from review of the application, especially FIG. 9, and also the parent application which correctly sets out "two-thirds". Applicant encloses herewith a copy of the JP application claiming the Convention Priority in US application showing that the original Japanese text does not disclose "one-third" but "two-thirds". If the Examiner considers it necessary, Applicant will forward an English translation of the JP application.

The Examiner has rejected claims 1-3 under 35 U.S.C. 103(a) as being unpatentable over JP '332 in view of Yoshida. Applicant respectfully traverses this rejection for the reasons indicated below.

To assist the Examiner's review, Applicant presents the features of the claimed roller bearing cage set out in claim 1 as follows:

1. The cage bars are arranged with their outside surfaces being in flush relation with the outside peripheries of the rims.

2. The cage bar has an inside surface that is sunk at an axial middle area thereof to form a recess extending in depth radially outwardly beyond a diameter across pitch circle on the rollers and in axial length shorter than the pocket.

3. The cage bar is made slender at the middle area thereof on account of the recess, with leaving axially opposing ends thereof thick.

4. Circumferentially opposing cheeks of the thick ends provide guide surfaces on which the roller rolls.

5. On the thick ends of the cage bar there are provided outside retainer lugs that jut into the pocket to keep the roller against outward escape out of the associated pocket and inside retainer lugs that also jut into the pocket to keep the roller against inward escape out of the associated pocket.

6. An annular corner where the inside peripheral surface and any one end of the axially opposing end surfaces of the annular rims merge with each other is chamfered off into a depth reaching two-thirds an axial thickness of the associated rim to form a slant annular surface, which slopes to a plane normal to an axial direction of the rim, with an angle less than 45 deg.

7. The slender area of the cage bar is defined in a manner having an inside surface of an axial length extending over a range of from 50% to 80% of an axial length of the pocket.

8. A slant surface connecting the slender area and any one of the thick ends is set to slope to a plane normal to the slender area, with an angle less than 45 deg.

In comparison to these features, FIG. 3 of Yoshida discloses a needle roller bearing in which the pockets in the cage are each provided at corners thereof with relief portions each extending circumferentially. The relief portions serve as passageways for lubricating oil.

In the Yoshida cage, the pillar portion, as seen from FIG. 2, is made in a nearly M-shape in axially cross section and comprised of axially middle portion, axially opposite portions and inclined portions, which are not different in thickness from each other, but are all equivalent in thickness with one another. Thus, the axially middle portion, axially opposite portions and inclined portions are uneven or bumpy radially with respect to the outside circular surface of the cage. The outside circular surface of the Yoshida cage confronting the outer bearing surface of the mating housing is reduced in area by the axially middle portion and the inclined portions. This makes it impossible to reduce the surface-to-surface contact stress which makes the bearing prone to seizure.

In further comparison, in the claimed cage, the cage bar is made smaller in thickness at the middle area thereof leaving the axially opposite ends thicker in comparison. That is, the cage bar, is made with a reduced area by the axially middle portion and the inclined portions. Thus, the outside circular surface of the cage is made radially in flush or even throughout the overall axial length including the annular rims confronting the outer bearing surface of the mating housing. The claimed construction of the cage bar makes it effective in reducing the surface-to-surface contact stress, and thereby reducing possible seizure of the bearing.

The inclined portions 1c3 of the pillar portion 1c of Yoshida are formed on their inner side with pocket wall surfaces 1a2, which make contact with the rolling surfaces of the needle rollers 2 on the pitch circles PCD. With this construction, the Yoshida rolling element is carried to a location near the axially middle area, which is smaller in axial width, and therefore prone to skew.

In comparison, the cage construction of the claimed invention, since the guide surfaces on which the roller rolls are provided at the axial opposite areas of the roller by the cheeks of the thick ends, can carry the roller over the

location large in axial width and, therefore, proves hard to incur the skew.

As seen in FIG. 7 of Yoshida, its cage construction has no retainer lugs to keep the roller against inward and outward escape out of the associated pocket. Upon assembling the roller in the cage, much care must be taken to keep the roller from falling away from the cage. Accordingly, this construction is hard to handle.

In the Yoshida cage construction, the inside peripheral surface of the pillar portion is set to slope to a plane normal to the slender area in an angle beyond 45 deg while the relief portions are provided at the corners of each pocket. As indicated earlier, the axial space in the radially inside surface is too small to provide the retainer lugs there, and further gets smaller in transverse section, smaller in modulus in section, eventually resulting in reducing the stiffness of the cage.

Moreover, in the Yoshida cage construction, the annular corner where the inside peripheral surface and end surfaces of the annular rims merge with each other, which unlike that of the claimed invention, undergoes no chamfering. Thus, the cited prior cage construction is not a solution that

staves off any interference with the edge of the mating crankpin.

Besides, the edge where the outside periphery and the side surface of the annular portion 1b merges with one another is cut largely to make a chamfered area of an angle as large as 45 deg. In contrast, the same edge in the claimed invention is rounded only slightly.

With regard to JP '332, FIG. 4 discloses a large end bearing 20 in which more than one needle 22 is held for rotation in two halves of a split bearing 21. The needle 22, as with the conventional roller, is made of, for example SUJ2 (high-carbon chromium bearing steel). The cage is coated with resinous material or tin and zinc to curb the electrolytic corrosion of the large end bearing 20, which would be caused either by any galvanic action that might otherwise occur between the needle 22 and the cage 21 or the crankpin 5a of the large end bearing 20, or by any corrosion of the needle 22 that might otherwise occur after a metal coating with little electric potential has been damaged. JP'332 maintains that this cage construction improves durability.

JP'332, although showing a split bearing in FIG.4 and an M-type bearing in FIG. 5, does not disclose or suggest

the cage construction of the claimed invention. JP'332 is merely directed to the surface treatment of the cage.

As shown in FIGS. 4 and 5 of JP'332, the M-type cage, which is made smaller in width of its bearing surface as in the cage construction of Yoshida and is therefore prone to skew.

With the Yoshida cage construction, the edge or corner where the inside peripheral surface and any one of the axially opposing surfaces of the annular rims merge with each other is chamfered off into a depth of a half the thickness with an angle not more than 45 deg to a plane normal to the axial direction. In contrast, the same edge or corner in the claimed invention is chamfered largely into the depth reaching two-thirds the thickness.

The prior art documents made of record and not relied upon have been noted along with the implication that such documents are deemed by the PTO to be insufficiently pertinent to warrant their applications against any of applicant's claims.

Applicant submits that the claimed invention patentably defines over the cited prior art.

Favorable reconsideration and allowance are earnestly solicited.

Respectfully submitted,

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ろの外方への脱落を阻止する外側保持用突出部と前記ころの内方への脱落を阻止する内側保持用突出部とが形成されていることを特徴とする請求項５に記載のころ軸受用保持器。

【請求項７】　前記半円環部の側面と前記半円環部の前記内周面とで形成される角部は，前記半円環部の内周面から肉厚の約３分の２の位置まで軸方向に垂直な面に対して４５°より小さい角度の傾斜面に面取りされていることを特徴とする請求項５又は６に記載のころ軸受用保持器。

【請求項８】　前記半円環部と前記柱部との前記外周面と前記合わせ面とで形成される角部は面取りされていることを特徴とする請求項１～７のいずれか１項に記載のに記載のころ軸受用保持器。

【請求項９】　前記半円環部の側面と前記半円環部の外周面とで形成される角部は，糸面取り程度に面取りされていることを特徴とする請求項１～８のいずれか１項に記載のころ軸受用保持器。

【請求項１０】　円環状保持器から成るころ軸受用保持器において，円環状保持器は軸方向に隔置して周方向に平行に延びる一対の円環部と前記円環部間で周方向に隔置してそれぞれ延びる前記円環部と一体構造の柱部とから構成され，前記柱部間にはころを収容するためのポケットがそれぞれ形成され，前記柱部の外側面は前記円環部の外周面と同一面に形成され，前記柱部の内側面における軸方向の中央部には，前記ころのピッチ円径よりも外側まで延びる深さで且つ前記ポケットの長さよりも短い長さの凹部が形成され，前記柱部の両端部が厚肉部に且つ前記中央部が前記凹部によって薄肉部に形成され，前記厚肉部の側面は前記ころを案内するころ案内面を構成し，前記柱部の前記厚肉部には，前記ポケットに突出して前記ころの外方への脱落を阻止する外側保持用突出部と前記ころの内方への脱落を阻止する内側保持用突出部とが形成されていることを特徴とするころ軸受用保持器。

【請求項１１】　前記円環部の側面と前記円環部の前記内周面とで形成される角部は，前記半円環部の内周面から肉厚の約３分の２の位置まで軸方向に垂直な面に対して４５°より小さい角度の傾斜面に面取りされていることを特徴とする請求項１０に記載のころ軸受用保持器。

前記柱部の前記厚肉部には，前記ポケットに突出して前記ころの外方への脱落を阻止する外側保持用突出部と前記ころの内方への脱落を阻止する内側保持用突出部とが形成されている。

【００１６】

前記半円環部の側面と前記半円環部の前記内周面とで形成される角部は，前記半円環部の内周面から肉厚の約３分の２の位置まで軸方向に垂直な面に対して４５°より小さい角度の傾斜面に面取りされている。

【００１７】

前記半円環部と前記柱部との前記外周面と前記合わせ面とで形成される角部は面取りされている。前記合わせ面付近の領域での前記面取り部は，前記円環状保持器に分割加工前に加工されるので，前記両半円環状保持器に跨がって平らな面に形成されている。従って，前記角部を面取りすることによって，ころ軸受用保持器の回転時に前記角部がコンロッド等の軸受取付部材の内周面に対して干渉することが防止され，スムースな回転をすることを可能にする。

【００１８】

前記半円環部の側面と前記半円環部の外周面とで形成される角部は，糸面取り程度に面取りされている。

【００１９】

また，この発明は，円環状保持器から成るころ軸受用保持器において，円環状保持器は軸方向に隔置して周方向に平行に延びる一対の円環部と前記円環部間で周方向に隔置してそれぞれ延びる前記円環部と一体構造の柱部とから構成され，前記柱部間にはころを収容するためのポケットがそれぞれ形成され，前記柱部の外側面は前記円環部の外周面と同一面に形成され，前記柱部の内側面における軸方向の中央部には，前記ころのピッチ円径よりも外側まで延びる深さで且つ前記ポケットの長さよりも短い長さの凹部が形成され，前記柱部の両端部が厚肉部に且つ前記中央部が前記凹部によって薄肉部に形成され，前記厚肉部の側面は前記ころを案内するころ案内面を構成し，前記柱部の前記厚肉部には，前記ポケットに突出して前記ころの外方への脱落を阻止する外側保持用突出部と前記ころの内方への脱落を阻止する内側保持用突出部とが形成されていることを特徴とするこ

内周面に局部的に強く当たることがなく，合わせ面８の領域で潤滑切れが発生することがなく，エンジンの高速回転に対応できる構造に構成される。

【００３３】

また，図３に示すように，柱部４の外側面２２Ｐは，半円環部３の外周面２２と同一面に形成されている。即ち，柱部４の外側面２２Ｐは，全長に渡って半円環部３の外周面２２と面一となっている。柱部４の内周面２４における軸方向の中央部には，ころ７のピッチ円径Ｄ（径方向に対向するころ７のピッチ円間の距離）よりも外側まで延びる深さであり，しかも，ポケット６の長さよりも短い長さのサイズを有する凹部１９が形成されている。従って，柱部４の内周面２４に形成された凹部１９によって，柱部４の両端部が厚肉部１３に形成され，中央部が薄肉部１４に形成される。厚肉部１３の側面は，ポケット（窓）６を形成し，該側面がころ７を案内するころ案内面１８を形成している。

【００３４】

柱部４の厚肉部１３には，ポケット６に突出してころ７の外方への脱落を阻止即ち規制するための外側保持用突出部１５と，ころ７の内方への脱落を阻止即ち規制するための内側保持用突出部１６とが形成されている。内側保持用突出部１６は，例えば，柱部４の内周面２４にローレット加工等で凹溝２８を形成することによって，ポケット６へ突出させることができる。また，柱部４の厚肉部１３に形成された外側保持用突出部１５の外側面は，柱部４の外側面２２に一致するように形成されている。

【００３５】

図３及び図９に示すように，柱部４の薄肉部１４の内側面２４Ｔの幅Ｂｉは，ポケット６の長さＢｐの５０％～８０％，好ましくは，図示のように６０％程度に設定されている。内周面２４での薄肉部１４と厚肉部１３とを結ぶ傾斜面２０は，薄肉部１４に垂直な面に対して傾斜角度（θ_2／２）が４５°より小さい角度，好ましくは，図示のようにθ_2／２が３０°に設定されている。また，半円環部３の側面２５と内周面２４とで形成される角部は，半円環部３の内周面２４から肉厚の約３分の２の位置まで軸方向に垂直な面に対して４５°より小さい角度θ_1の傾斜面２１に面取りされている。即ち，半円環部３の面取りの傾斜面２